Space Weather Technical Forecast

Issued on Wednesday, 23 August 2023 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Ongoing chance of M-flares (R1-R2 Radio Blackouts). Slight chance G1 Minor Storms late day 1 or day 2 (23-24 Aug).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with the peak flare a M1.1 at 22/2304 UTC from the AR3405 region in the western disk. There are currently eight numbered regions on the visible disk. The majority are simple and mature unipolar or bipolar spots with little development. However, the newly numbered AR3415 region rotating onto the southeast limb, along with the likely simpler, but moderately sized AR3413 and AR3405 provide some increased flare risk. The new region is a modestly sized, apparently compact region, and has been tentatively analysed as such, although this assessment is low confidence, and further details are expected to become apparent as it rotates into a clearer view.

A filament eruption was observed leaving the southwest disc at 21/1613 UTC, and a weak CME has been identified in the very limited SOHO LASCO imagery that is available. Confidence is very low, however at a weak glancing interaction is possible later in the period. The recent M1.1 flare from the AR4305 region also looks likely to have produced some element of filament lift-off from a similar part of the disk, and any resulting CME will be analysed as imagery becomes available.

Solar Wind / Geomagnetic Activity: The recent fast wind, from an unnumbered coronal hole, eased through the period. Solar wind speeds measured by DSCOVR eased from elevated to be slightly elevated (around 520km/s to 450km/s). Density was near average. Total Interplanetary Magnetic Field (IMF) Bt, was weak, generally below 5nT, with the north-south component, Bz, also varying weakly between -4 and 4nT. Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at Background. GOES16 high energy (greater than 2MeV) electron flux ranged from Background to Moderate. The associated 24-hour fluence was well below the Active level, with an observed value of 8.7e6 integrated pfu at 23/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity is expected to be generally Low, but with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently forecast, however the filament eruption leaving the disc on 21 Aug has been tentatively assessed as giving the risk of a glancing transitory influence towards the end of the period. Current fast winds are expected to continue gradually and erratically easing into day 1 (23 Aug), before the potential arrival of the next fast wind enhancement, from CH39/+ in the southeast. This is a low confidence feature however. Enhancement is most likely late day 1 or day 2 (23-24 Aug), with solar winds potentially rising again to around 500-550km/s. Mainly Quiet geomagnetic activity at

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first, with isolated Unsettled spells. There is a slight chance of Active intervals, most likely later day 1 and day 2 (23-24 Aug). There is a slight chance of isolated G1 Minor Storms with any arrival. Activity is expected to ease back to be mostly Quiet to Unsettled days 3 and 4 (25-26 Aug).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at Background levels, with a slight increase in risk by days 3 and 4 (25-26 Aug). High energy electron flux (greater than 2MeV) will vary from Background to Moderate day 1 (23 Aug) before a subsequent drop out is expected from any fast wind arrival late day 1 or day 2 (23-24 Aug). Flux is then likely to increase again days 3-4 (25-26 Aug) as any enhanced solar winds ease. The associated 24 hour fluence is expected to remain below the Active threshold (1e8 integrated pfu).

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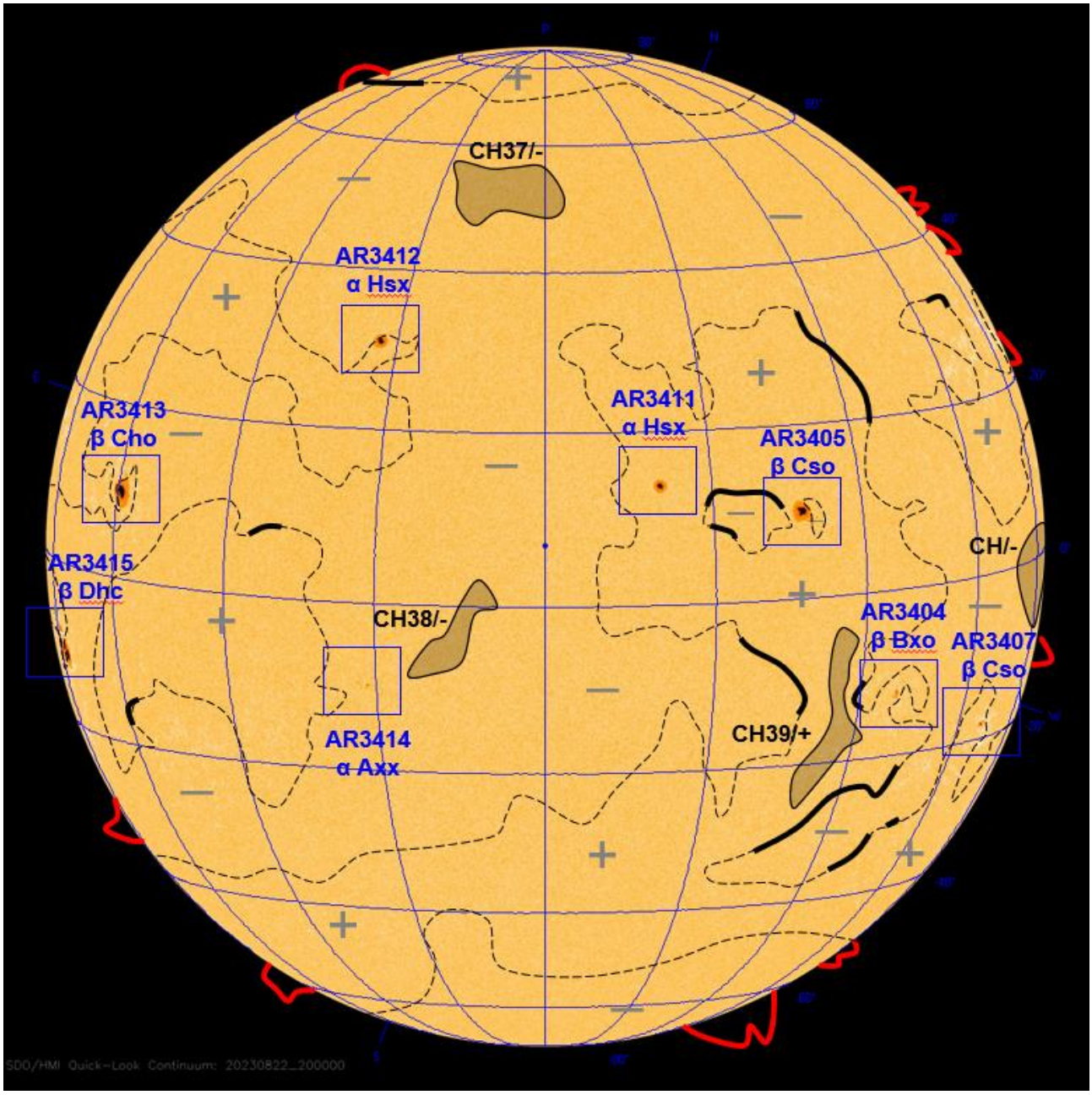
Figure 1. Solar Analysis Valid 22/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs forecast, however a filament eruption from the vicinity of AR3404 was observed around 21/1615 UTC, has been tentatively assessed as giving the risk of a glancing transitory influence towards the end of the period. The recent M1.1 flare from the AR4305 region around 22/2300 UTC also looks likely to have produced some element of filament lift-off from a similar part of the disk, and any resulting CME will be analysed as imagery becomes available.

Recent fast wind enhancement continues to ease, with the next most likely source of any increase in speed to be from any interaction with CH39/+. This is a small positive coronal hole in the southwest disc, but due to nearby active regions contaminating imagery of the feature is uncertain in extent. 27-day Persistence is also contaminated from a CME arrival, so despite the coronal hole being present on the previous rotation confidence is reduced. Very little enhancement is indicated in ENLIL modelling, however this failed to detect the recent fast wind enhancement and is not viewed as providing good guidance currently. Overall, this leads to low confidence in the forecast, however an enhancement to around 500-550 km/s is currently considered possible, most likely later day 1 or day 2 (23-24 Aug) before declining. Some further enhancement is possible very late in the forecast period in association most likely with CH38/- near centre disk.

Mainly Quiet geomagnetic activity expected at first, with isolated Unsettled spells. There is a slight chance of Active intervals, most likely later day 1 and day 2 (23-24 Aug) from any fast wind arrival from CH39/+. Due to the Russel-Mcpherron effect, increasing the geoeffectiveness of positive coronal holes at this time of year, there is a slight chance of isolated G1 Minor Storms with any arrival. Activity is expected to ease back to be mostly Quiet to Unsettled day 3-4 (25-26 Aug), with significant geomagnetic activity associated with CH38/- not expected during this forecast period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	20	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity – Earthbound Coronal Mass Ejections

Nil

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Radio Blackouts - X-Ray Flares:
The current Low to Moderate activity expected to generally continue, but with a chance of Moderate activity from isolated M-Class flares and a very slightly raised risk of isolated X-Class flares and High activity. There are currently seven numbered regions on the disc, however most of these are either small and simple or stable mature unipolar spots, with only a slight chance of elevated flare activity. The predominant flare risk looks to be from the newly numbered AR3415 spot that is rotating onto the disc. This region is still difficult to accurately assess due to its position, however it is an apparently compact region and has been assessed as such with low confidence. As this moves into a less oblique viewing angle any complexity is likely to become increasingly apparent and flare risk may change.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: Latest 24hr X-Ray Flux

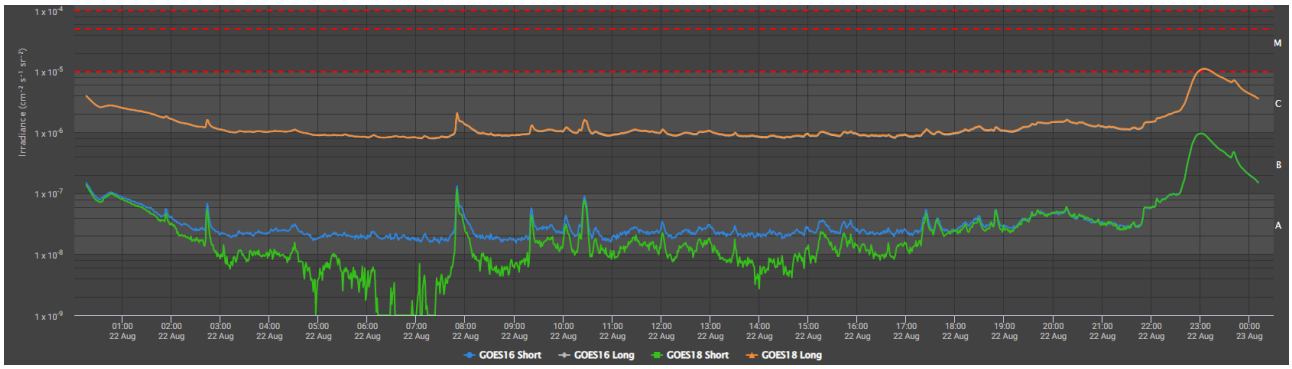

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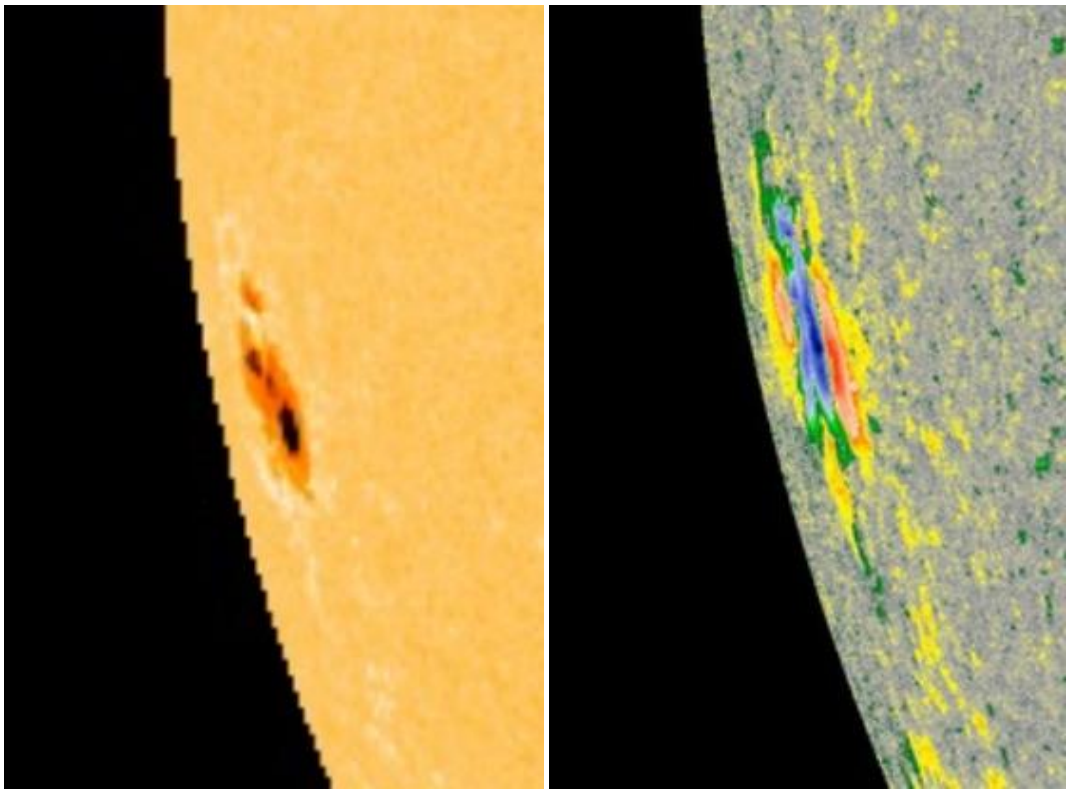
Figure 3: SDO intensitygram and Magnetogram of new AR3415 region on Eastern limb



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Solar Radiation Storms - (High Energy Protons):
High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at Background levels, with the spots on the western disc currently small and simple, though a slight increase in risk expected by days 3 and 4 (25-26 Aug) as the current larger and more complex spots currently near the eastern limb rotate towards centre disk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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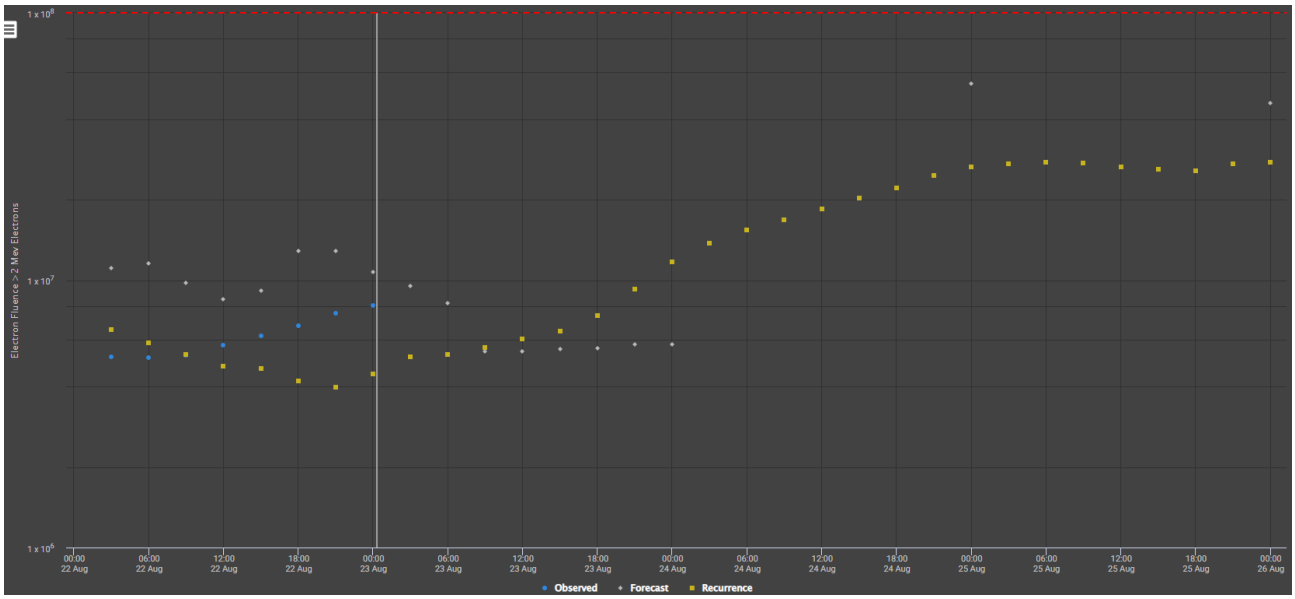
High Energy Electrons Event (≥ 2MeV):
High energy (greater than 2 MeV) electron flux observed by GOES-16 is currently varying between Background and Moderate, due to recent fast wind arrival. However, due to the lack of notable geomagnetic activity with this enhancement, the influx of electrons into the Van Allen belts is currently expected to be limited, with peak flux persisting at Moderate, perhaps just briefly reaching High levels day 1 (23 Aug). Any further HSS solar wind enhancement day 1-2 (23-24 Aug) then likely drop out observed flux to background, before an increase to Moderate, perhaps High levels days 3 and 4 (25-26 Aug), as solar winds ease.

The associated 24 hour fluence is expected to persist below the Active level to start, with no significant enhancements expected. An increasing trend is expected day 3 (25 Aug) onwards, with the risk of breaching the active level increasing but still low. MOSWOC REFM model currently looks to be providing reasonable guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	15
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model output



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